by fungus. No mealy bug (*Pseudococcus nipae* Mask.) was observed. The humid climate of the Kona district, along the main road is perfect for the growth of this plant, and it is practically free from natural enemies. Even the fruit showed little infestation from fruit fly (*Ceratitis capitata* Wied.).

Pests of Pineapple in Hawaii

J. F. ILLINGWORTH

(Presented at the meeting of May 3, 1928)

A. Affecting the root system:

1. Snails (*Caecilioides baldwini* Ancey) feed on the root tips —favor moist location, not widely distributed.

2. Symphylids (*Scutigerella immaculata* Newport.). Very similar in habits and distribution to the above. Very destructive to root tips wherever they occur.

3. Mycetophilidae (*Sciara molokaiensis* Grimshaw). Periodic in occurrence, following wet weather; larvae gnaw tender young root tips during periods of drought.

4. Collembola. Numerous species occur in pineapple soils,—a slender white form in great numbers. These gnaw pits in living roots during dry spells.

5. Mites. (*Rhizoglyphus phylloxerae* Riley). Very destructive in a few localities.

6. Mealy bugs (*Pseudococcus brevipes* Cockerell) congregate on young roots in fields poorly prepared.

7. Nematodes—several species, very destructive.

Minor pests: Pauropodidae, *Japyx* sp., sowbugs, pillbugs, burrowing cockroaches (*Pycnoscelus surinamensis* Linnaeus), scarabaeid grubs (*Adoretus sinicus* Burmeister), Fuller's rose beetle (*Pantomorus godmani* Crotch), several species of tiny centipedes, etc.

B. Affecting the fruit, stem and leaves:

1. Mealy bug (*Pseudococcus brevipes* Cockerell).

2. Scale (*Diaspis bromeliae* Kerner).

Both the mealy bug and scale congregate on plants that are fail-

ing from other causes. The former are sometimes troublesome on fruits. Both are held pretty well in check by natural enemies.

3. Budmoth (*Batrachedra rileyi* Walsingham). The tiny pink caterpillars of this species are particularly troublesome on the fruits. They live in the withered flowers and outer calyx cavities and frequently gnaw the leaves of the crown. Rot organisms enter through the wounds, causing the breaking down of the fruit. (See Pineapple News, July, 1927, pp. 67-71.) The webs of the larvae collect all sorts of litter, giving the fruit a bad appearance. This pest is pretty well controlled by predacious wasps and beetles, collecting the caterpillars for food.

4. Souring beetles (Nitidulidae). There are about five exotic species found in pineapple fields. The one most troublesome and abundant is *Carpophilus humeralis* Fabricius. These beetles are pests of the plant at every stage of its growth. Starting when the planting material is put into the soil, they congregate on the butts, gnawing out the starchy material between the fibers, they oviposit there and the developing grubs frequently cause the breaking down of the plant, by feeding at the base of the lower leaves, where rot-fungi are introduced. When abundant, they gnaw cracks between the lower eyes of the fruit, followed by fermentation.

5. Midges (Chironomidae). The larvae of a tiny gnat (*Apelma brevis* Johannsen) are always present in the water-pockets between the leaves of growing pineapple plants. These normally feed upon the accumulations of wind-borne trash that collects there, but occasionally they rasp the very tender white tissue at the base of the new leaves, permitting the entrance of rot-organisms.

6. Pineapple mite or red spider (*Stigmaeus floridanus* Banks). These mites are now widely distributed in our pineapple fields, but for some reason they have never become a serious pest. They are frequently seen when stripping planting material, congregated between the lower leaves. They cause a drying out of definite spots where the colonies are located, but apparently disappear as the plant begins to develop.

Minor Pests: Grasshoppers (*Oxya chinensis* (Thunb.) and *Atractomorpha ambigua* Bolivar), Crickets (*Gryllus oceanicus* Le Guillon), flies (*Atherigona excisa* Wied., *Euxesta annonae* Fab.,

and *Drosophila repleta* Woll.). Ants attending mealybugs (*Pheidole megacephala* Fabr.) and ground beetles (Tenebrionidae).

Grasshoppers Eat Pineapple Mealy Bugs and Other Pests

BY J. F. ILLINGWORTH

(Presented at the meeting of July 5, 1928)

On June 20 while collecting mealy bug material at Waipio, for experimentation in the laboratory, I noticed that most of these pests had disappeared. A few weeks before the small fruits in a wilting section of the field were thickly plastered with mealy bugs, hence I was interested to know what had become of them.

The field had become very weedy, and I noticed great numbers of our small, green, longhorned grasshopper (*Conocephalus saltator* Sauss.) especially about the plants. Swezey (Bul. 1, part 7, pp. 212-214, Div. Ent., Exp. Sta. H. S. P. A., Dec., 1905) reported this locust as largely predaceous upon the sugar cane leaf hopper, during his investigation of that pest. He found that it also fed sparingly upon the flowers of lantana and canna, and that it liked the leaves of honohono, but seldom touched sugar cane. In September, 1926, I first observed these hoppers feeding upon pineapple mealy bugs.

June 22, 1928, six of the half grown hoppers were collected in the field, and placed in separate glass tubes, to test out their feeding habits. Each was supplied with twenty mealy bugs, and flowers of pigeon pea and alfalfa. The bugs were soon devoured, and there was only slight nibbling at the blossoms. A fresh supply of mealy bugs was put into each tube whenever the old ones were eaten. I kept them in this way for one week, when the total numbers of mealy bugs devoured were 110, 95, 90, 80, 70, and 50.

The young grasshoppers also showed a decided liking for both the caterpillars and pupae of our various bud moths, pests so troublesome on the young fruit. Furthermore there appeared to be no desire to eat the pineapple foliage, though the fresh blossoms were nibbled slightly.

I do not think there is any question but that these hoppers were

the principal agent in clearing out the mealy bugs. They certainly are valuable predators to have in our fields.

As a matter of fact, however, they do not thrive in our good fields, and we seldom see them. It is only when the place is practically abandoned, and growing up to weeds, with multiplying insect pests, that these grasshoppers congregate. At any rate, they do much to rid us of some of our most troublesome pests—nipping them in the bud, so to speak. Without such friends, helping to keep the balance of nature, the growing of crops would soon become impossible.